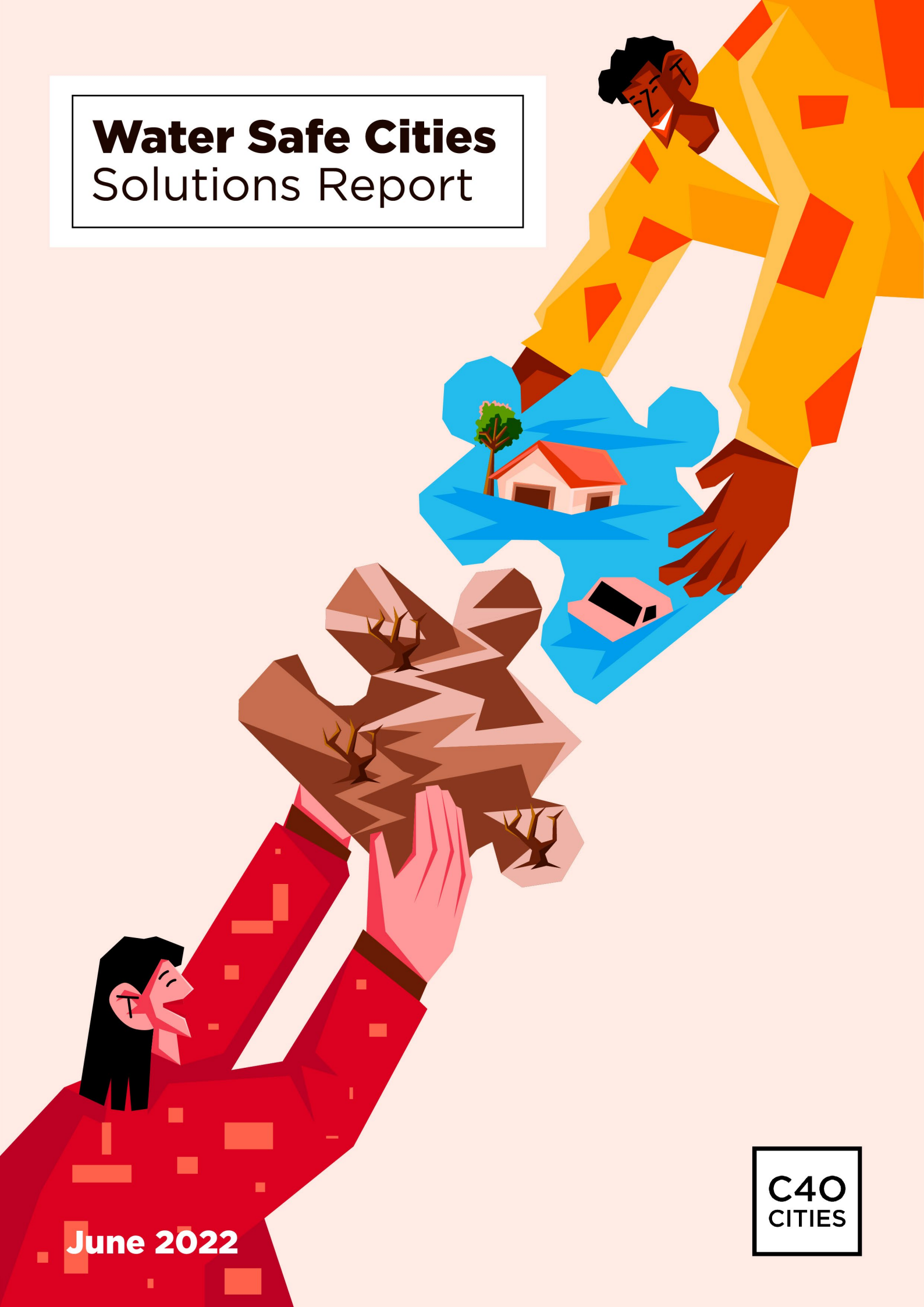
Water Safe Cities
Solutions Report



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C40 CITIES

Technical assistance

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What we aim to do

According to C40 research, by 2050, more than 800 million people living in cities will be at risk from sea-level rise.[1] Some 685 million city residents will face a decline in the availability of fresh water.[2] With sea-level rise comes the risk of disruption to energy supplies and the economy. In 2021 alone, the economic losses due to climate change amounted to US$ 343 billion.[source]

The message is clear: we need to act immediately to safeguard people. The latest report by the Intergovernmental Panel on Climate Change (IPCC) has raised alarm bells and demanded immediate action if we want a safer and more resilient world [3].

Amid increased urbanisation and the impacts of climate change, cities are facing exponential growth in the risk of water-related climate hazards – floods, droughts and storms. They are also facing issues associated with water sanitation, a lack of safe and accessible drinking water, water quality and water conflict, among other things. These challenges have a significant impact on the health and wellbeing of communities and individuals, and on the economic growth and development of cities. It is as much a humanitarian crisis as it is an environmental, social and economic one.

The Water-safe Cities project established by C40 in collaboration with the Grundfos Foundation aims to sharpen the focus on water and climate change and has three main components:

- Undertaking research to illustrate the impact of climate change and water-related hazards in cities.
- Establishing a water security network to facilitate peer-to-peer engagement between cities.
- Providing technical assistance to support cities in implementing water actions.

As part of the Water Safe Cities project several technical assistance programmes were developed to offer focused support to cities. The aim was to use the knowledge gained from C40 water networks to accelerate the implementation of water-related adaptation measures in other C40 cities.

The selected cities had a variety of implementation challenges, ranging from governance issues and a lack of data to a lack of funding. Programme support was diverse; supporting cities with knowledge exchange and inspiration, as well as deeper engagement in framing the development and initiation of strategies, policies and pilot projects.

The supported cities were selected according to a set of parameters to ensure project diversity:

- Differing geographical regions.
- Water-related challenges (drought, flooding, sea-level rise, etc.).
- The distribution of Global North and Global South cities.

The technical assistance has encouraged cities to share their practices and knowledge with other cities that may be facing similar challenges. In this way – especially through the C40 networks more cities can be helped to move towards a more water-resilient future.

Methodology

Identifying and prioritising which water-related issues or challenges could feasibly be addressed in each city was crucial. The first step was to define the main problem and identify workshop participants. This ensured that key stakeholders within and outside the city administration were taken into account, as water governance varies from city to city.

After deciding on the key topics, the workshop programmes were prepared in close collaboration with the cities in question. This included identifying other cities that had faced similar issues or challenges and proposed solutions. The workshops themselves included a mix of presentations, discussions, brainstorming and interactive design-led thinking. The following section on Cities and solutions outlines the technical assistance offered to a group of cities, the issues they sought to address, the solutions they are implementing (and the challenges therein), the other cities that have inspired them, and what other cities can learn from them.

Cities and solutions

Strategy and implementation: Buenos Aires - depaving

Introduction

Climate change is affecting cities in many ways. One of the most common impacts is flash flooding due to heavy rains, which causes damage to property and, worst case, poses a risk to people's lives. Cities are also looking for solutions to the urban heat-island effect, which presents challenges in hot summers [4].

Cities, including Buenos Aires, are turning to nature-based solutions to combat these effects [5]. The Argentinian capital has been growing rapidly. It currently has a stormwater system based primarily on grey infrastructure, including a large number of covered streams and smaller rivers, but the city's ability to manage stormwater is limited if amounts increase because of climate change.

Buenos Aires wants to reconnect the urban layout of its city with the original landscape, to restore the urban ecosystem. As part of this process the city wants to create a strategy for depaving streets to increase water retention and infiltration.

The issue

Buenos Aires is experiencing repeated flooding and, with the changing climate, this is expected to increase. The city's stormwater and sewer systems are based on pipes and the increasing amount of rain is pushing the systems to capacity, often leading to surface flooding. This is on top of more frequent combined sewer overflows, which are polluting the city's rivers. Originally, Buenos Aires had a number of smaller local rivers that helped with drainage, but as housing and paved areas became more dense, many of these rivers and streams were covered in and are now part of the overall drainage and sewerage system.

The municipality wanted to boost community knowledge of the rivers and include green cover in its work to prepare the city for future climate change. Increasing community knowledge and understanding how water, nature and the city can work together is an important part of its approach to climate change adaptation. It can also help address certain equity issues by providing a higher-quality living environment for all communities and facilitate access to nature for all.

Without action, Buenos Aires risked facing more severe adaptation challenges in future. In addition, access to green spaces and nature for all communities was a key equity challenge the city hoped to address with its depaving strategy.

The road to implementation

To develop its strategy, the city of Buenos Aires embarked on a multi-stakeholder process, setting a common long-term vision aimed at addressing the city's water-related challenges:

> "We want to get back the relationship between people and water in the City, centred on respect for nature, enjoyment and resilience.[6]"

With a clear vision, the city, with the support of Water-safe Cities' technical assistance, embarked on a process to inform itself on how best to start the depaving actions. It mapped the main areas likely to experience flooding and heat hazards, along with those where more green spaces were needed and those with the potential to create green corridors. The city further analysed its population density and mass-transit characteristics. The results allowed it to select areas that should be prioritised for pilot depaving projects, as these would have the highest co-benefits.

Most cities aiming to implement green and blue infrastructure to combat urban heat and surface flooding do not have a dedicated budget to fund their plans. Buenos Aires is no exception. The city received external funding from the World Bank to help it kick-start two pilot projects in areas selected through the technical assistance support programme.

The first project is scheduled to start in late 2022. It has an intervention area of four blocks, covering around 10,000 square metres, of which 2,000 are new green areas. The second pilot will be of similar size.

The city plans to continue the programme with new green streets, using the map it developed as a guide. It will also analyse the effects of the pilot projects, monitor their use and take into account lessons learnt.

A strategy is important when taking a gradual implementation approach, so that the work can be planned over a number of years. This will enable the city to piggyback on street maintenance and other public works, making implementation swifter and more affordable. To do this successfully, it is also important to have the correct hydraulic criteria for the whole basin and for each individual project. This approach must be adaptive to both climate change and the general development of the city, given the relatively long implementation period.

What are the implementation challenges?

A depaving strategy presents challenges for most cities. Here, too, Buenos Aires is no exception:

- **Citizen engagement or creating local acceptance and understanding of the project.** It is important to have a process that includes citizen engagement and local discussions on street design, how traffic and parking can be organised, and the recreational features of the streets. Failure to do this can fuel local resistance, which can also pose a challenge to future projects.
- **Integration of projects into long-term planning.** Having an overall workplan for local depaving projects is crucial, but cities are always changing, so it is important to build flexibility into street design and function. It is crucial to maintain focus on the hydraulic functions of the streets in question.
- **Balancing grey and green.** Although the overall aim of Buenos Aires' depaving strategy is to create a greener and more resilient city, there is always the reality of urban design to contend with. This may challenge how much green can be implemented. There will be projects where grey infrastructure will be necessary for hydraulic purposes.

Impacts and benefits

Nature-based solutions are being praised as being a cheap and efficient way for cities to mitigate the effects of climate change. Although they do not offer complete solutions – sometimes cities will need grey infrastructure to supplement the nature-based approach – one of the key arguments for using such solutions is their wide array of added benefits. This is also the case in Buenos Aires, where the city has identified possible benefits from such an approach. Nature-based solutions could:

- Relieve the stormwater system.
- Promote sustainable mobility.
- Reduce the heat-island effect (reduce the temperature in the streets).
- Generate changes in community habits and improve the relationship with nature.
- Contribute to a city centred on waterways and nature.
- Reduce greenhouse gases and increase carbon sequestration.
- Incorporate native vegetation and generate new ecosystems.

Which cities inspired Buenos Aires?

Buenos Aires has been very active in seeking inspiration from other cities, such as Paris and Copenhagen. The city has a bilateral collaboration agreement with the city of Copenhagen, supported by the Danish Ministry of Foreign Affairs. Thus, Copenhagen's cloudburst management strategy and focus on the co-benefits of adaptation work have had a major influence on Buenos Aires' approach.

Similarly, Rotterdam and Amsterdam are working to depave their cities. Both have public and private initiatives underway based on analyses of the need to decouple stormwater from city sewer systems. Amsterdam's plan, 'Every drop counts', enables the city to capitalise on opportunities that arise to make public investments in streets and new buildings. Rotterdam is also availing of opportunities to upgrade public areas to increase green space and the city's depaving campaign has now gone national. Private citizens in Rotterdam are even depaving gardens and personal spaces to make more room for water. All of these initiatives could potentially work for Buenos Aires.

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Conclusions and lessons learnt

A critical element of the work in Buenos Aires is public engagement. **Getting local acceptance of and involvement in individual projects is key to the successful implementation of the strategy.** There will inevitably be local opposition focused on accessibility, parking and local transport. Communication will be needed to allay a common local concern about having more water on the surface in a dense city. The authorities need to make clear that this reduces the risk of flooding rather than increases it. For Buenos Aires, this will be a key feature to take into consideration going forward.

What can other cities learn from Buenos Aires?

Buenos Aires' depaving strategy has a number of lessons for other cities:

- Creating a strategy that covers a large area will enable cities to piggyback on other projects such as street maintenance. This will also dramatically reduce the cost of implementation.
- The importance of having a multi-stakeholder process, involving different city departments, is crucial to developing and implementing a depaving strategy.
- Gradual implementation makes it possible to adapt the strategy as the city develops and changes.
- The possibility of a number of co-benefits will foster local acceptance of projects. It will also help to communicate how climate change adaptation can be used to solve other issues in the city not just physical, but social ones too.

Knowledge sharing: Istanbul - non-revenue water reduction

Introduction

All of the drinking water in Istanbul comes from surface water sources, stretching from Kırklareli in the west of the city to Düzce in the east. The widespread locations of the city's water sources is a key challenge, with 60% of water resources sitting on the Asian side, where 35% of the population lives, and 40% on the European side, where 65% of the population lives. Because of this, the water reservoirs are linked for operational flexibility. **Istanbul already meets the legally binding target set by the government for all Turkish metropolitan and provincial municipalities of reducing water losses to 25 percent by 2023.** However, there is still room for improvement compared with other countries, such as Denmark, Germany and the Netherlands, which have average water losses of less than 10 percent.

Istanbul was recently severely water stressed and, while the recent drought has ended, the city's water supplies are likely to come under further pressure in the near future due to a combination of climate change, a growing population and industrialisation.

The issue

Istanbul has historically always faced issues of water scarcity because of its location far away from drinking-water sources. In recent years, the city's water reserves have been drying up. In early 2021, its reservoir levels dropped below 20%, which left the city with approximately 110 days of water[7]. Over the last 40 years, Turkey has suffered a period of drought every four to seven years.[8]

Ageing infrastructure and declining water resources are major concerns, so controlling water loss has become a priority for the public water utility, Istanbul Su ve Kanalizasyon Idaresi (ISKI). In 2020, the city's non-revenue water (NRW)[9] was around 21%, although this was a significant improvement from the 65% loss reported from the supply network in the early 1990s. The city aims to implement a strategy to further decrease and contain water losses. The NRW stems mostly from underground leaks in watermains and water service pipes, however, the losses include any water that has entered the network following treatment and fails to get through to consumers.

The solution

The city is looking to develop a new NRW strategy and implementation plan. This will include:

- Establishing a strategy development team.
- Setting appropriate NRW targets.
- Prioritising NRW reduction components such as awareness, location and repair.
- Allocating budget for strategy implementation.

Developing a strategy helped the city of Istanbul to gain a better understanding of the amount and sources of its NRW and the factors influencing or causing it. It then set about gaining more knowledge on how to best implement its NRW strategy.

The city prioritised the following set of activities:

1. **Hydraulic modelling:** Mathematical modelling of the physical state of the water system is a common approach to NRW management when the system cannot be experimentally reconstructed or if it is very costly to do so. Such modelling is crucial to controlling the system and optimising its management, creating a strong decision-support system and ensuring operational sustainability.
2. **Pressure management:** The city is looking to set target levels for discrete zones in the water distribution network, such as district metered areas (DMAs) or pressure management areas (PMAs). It will then aggregate these to set the water utility's overall leakage target. The city is also undertaking zero-pressure tests.[10]
3. **Digital solutions:** Istanbul is looking to develop a drinking-water decision-support and analysis system, which will allow the city to monitor and analyse the quantity of water delivered on an hourly, daily and monthly basis and to monitor water consumption during the day and at night in each DMA region. In addition, the city is looking to install more remote reading applications, as the current rate of remote meter reading is only 0.7%. The city is seeking innovative input on the installation of an integrated system into its existing Supervisory Control and Data Acquisition (SCADA) system[11], whereby the system can be remotely controlled.
4. **Active maintenance:** Istanbul is further conducting loss-leakage estimates and intervention studies (listening, monitoring, excavation) by tracking exceptional changes in pressure and flow values. Within the scope of these maintenance projects, physical water losses have also been detected. Renovation works are also being carried out on transmission lines.

Impacts and benefits

Active maintenance, such as infrastructure management, active leakage control and speed of repair, are some of the most cost-effective measures for limiting water loss if carried out in accordance with targeting studies and water audits, which can determine and even predict the parts of the water system most prone to breaks and leaks. The implementation of smart water network solutions will support the city in improving the reliability of its physical water infrastructure by collecting and analysing data more efficiently. They will also offer the opportunity to improve productivity and efficiency while enhancing customer service.

Which cities can inspire Istanbul?

São Paulo's performance-based service contracts: Companhia de Saneamento Básico do Estado de São Paulo (SABESP), the utility that serves the São Paulo Metropolitan Region, is one of the largest public water utilities in the world, with a supplied population of around 25 million. The utility takes a proactive approach to water-loss reduction with the help of the local private sector. Leakage reduction activities are routinely carried out by a series of leak-detection contractors that are paid by the length of distribution network surveyed. Close to 40 percent of the 26,000-kilometre network is surveyed each year. SABESP decided to explore innovative ways of engaging the private sector in performance-based arrangements to manage the city's water resources more efficiently. These contracts vary in their objectives, but broadly focus on the reduction of bad debts and customer meter replacement. This approach is particularly suited to field work, such as leak detection, pipe repairs, minor civil works, meter replacement and reading, updating the cadastre and identifying illegal connections.

Singapore's pipe protection and public awareness: Singapore's water is managed nationally by the Public Utilities Board (PUB). With limited land available to collect and store rainwater, Singapore is no stranger to drought, which prompted it to seek out innovative solutions and develop strategies to secure sustainable water supplies. The city embarked on a water conservation awareness programme through mass-media outreach and extensive public engagement. This involved programmes to reduce unaccounted-for water and other water losses. The outreach activities included incorporating a topic on water pollution and conservation into the educational curriculum to educate young people on the importance of water conservation.

Singapore also created the Friends of Water programme to encourage community water stewardship. In recent years, the PUB has also adopted a pre-emptive leak management approach, proactively replacing older or leak-prone pipes. It has used pipe condition assessment technology and data analytics to determine the health status of the pipeline network to prioritise replacement. One of the PUB's key focus areas is regular asset renewal and maintenance to ensure that the water network is resilient. The city is able to achieve this by anticipating and responding to leaks and damage with minimal disruption to operations. The city is on track to replace the majority of its leak-prone pipework, more than tripling its replacement rate between 2016 and 2019.

Oslo's digital solutions: Norway has historically had almost unlimited access to drinking water at quite low cost. Consequently, there has been little focus on NRW and high NRW levels were not unusual. This has changed over the past decade, as high NRW has also led to high maintenance and production costs. The city embarked on several initiatives between 2015 and 2020 to reduce NRW levels to 20%. It implemented an online hydraulic modelling system, Aquis, and integrated it into the SCADA system, giving the city a real-time overview of the state of the water distribution network. The model is used for online monitoring, planning, design and optimisation. The city has been focussing on minimising background leakage by optimising the existing system.

Durban-eThekwini's pressure management: Durban has implemented a pressure management solution to provide near-real-time remote control of the pressure in its water pipes to minimise water loss. Pressure management involves the installation of pressure-reducing valves (PRVs) at key locations in the water distribution system that could experience excessive pressure, potentially resulting in higher leakage levels.

The city aimed to decrease real losses as much as possible without adversely affecting customer service or compromising the safety of the water network. By reducing pressure in the network, the city was also able to reduce the amount of water leaking through small undetected holes. Advanced pressure management consists of time- and flow-related pressure control valves and works best in specific locations in a water network, for example, in places with high water wastage or high water pressure. The effectiveness of applying advanced pressure management also depends on the topography of the potential implementation area. It works best in locations where bulk water is supplied from a high point to a low point. By implementing these measures, Durban was able to save approximately 3.1 million litres of water per day and reduce total mains pipe bursts by more than 60%. This also resulted in a reduction in burst repair costs and the extension of the life of the existing infrastructure and assets. [12]

Tshwane's capacity building: A capacity-building partnership between the Danish city of Aarhus and the South African city of Tshwane aims to train water-sector employees in the management of NRW. The city has identified an area that could serve as a pilot zone for collaboration on matters relating to NRW, with the specific purpose of knowledge sharing, skills development and exploring international best-practice solutions. Past and current activities undertaken in the zone by the water team include:

- The collection of all historical detail pertaining to the zone.
- The initiation of an external meter audit and visual inspection and replacement of various meters.
- The deployment of leak-detection teams, primarily to locate underground reticulation leaks in the zone.
- The identification of pipes with high failure rates and the mapping of annual failure trends.

The outcome of each initiative on minimum night flow will be monitored and the information will be used for benchmarking purposes in decision-making processes. The work already undertaken in Tshwane has given the project team an in-depth understanding of the network characteristics of the zone and the influence they have on NRW.

Combining technologies in Copenhagen: Copenhagen has been working for years to reduce both water consumption and loss. Today the average citizen in Copenhagen uses less than 100 m3 of water per day, while the water loss is on average 6%. The city has started to install smart meters, with the aim over covering the city in full by 2026. Combined with systematic work on pipe replacement, supported by a modelling tool for replacement prioritisation, leak detection will be even more efficient in future. The Greater Copenhagen Utility has been working on combining technologies to reduce the loss of water. This has been done, among other things, through the Leakman project, which combines intensive monitoring of the water system with quick and systematic leak detection and repairs. The aim is to reduce the number of events where consumers lose access to water due to burst pipes. By systematically detecting leaks, the utility can repair minor leaks before they develop into larger bursts.

Conclusions and lessons learnt

The efficient management of water resources is becoming ever more necessary. Though municipal authorities are aware of this, NRW is still excessive in many cities around the world. Istanbul's NRW management will allow the city to expand and improve services, enhance its financial performance, increase climate resilience and reduce energy consumption. NRW data for the city indicate that there is still room for improvement when it comes to water resource management. **Istanbul could avoid, or at least postpone, the need to build new dams with a more strategic focus on water-saving and -efficiency measures.** This includes minimising losses in water distribution systems, installing water-saving devices and raising public awareness.

What other cities can learn from Istanbul

Identifying how much water is being lost is the recommended starting place for utilities and practitioners. A key message is that percentages are not the only means of measuring losses when gauging progress, nor are comparisons with similar utilities. Emphasis needs to be placed on having accurate data on flow into water distribution networks and water pressure variances. These are prerequisites to identifying where the greatest leakages are and how they can be stopped.

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Governance: Johannesburg - integrated water governance

Introduction

The city of Johannesburg is the economic capital of South Africa, a developing country that is water scarce, thanks to its semi-arid climate and average rainfall of 450mm per year compared with the global annual average of 790mm per year.[13] The city is the capital of Gauteng Province, the smallest and wealthiest of South Africa's nine provinces. The treated drinking-water supplier for the region is Rand Water, and Johannesburg accounts for 40% of its total supply. As with other cities, the approach to stormwater in Johannesburg has been to dispatch the water as quickly and efficiently as possible towards 12 river systems and 106 dams within the municipal boundaries. This is complemented by detention and retention ponds, as well as wetlands and other natural features that retain water.

The issue

Johannesburg's surface water sources are currently stressed and the strategy for countering this relies mainly on the implementation of water-saving measures and water reuse. The city's water-services entity, Johannesburg Water, has been struggling to keep demand below the city's water allowance and to meet the basic water and sanitation service needs of the current population.

Moreover, although the groundwork for better water management has been laid in stormwater management bylaws, among other things, the benefits have been hampered by slow implementation. Action is being held back by a fragmented institutional model, as the provisions need to be applied by several teams within the city administration. Not only are the roles and responsibilities of these teams unclear, but their mandates are often conflicting, leading to a lack of coordination. Drought and other climatic variations in the region are projected to increase in frequency in future decades, underscoring the need for stronger and more focused governance.

Water-safe Cities' technical assistance aimed to support Johannesburg in two ways: developing a new approach to managing stormwater and reclaiming stormwater to mitigate water-shortage issues.

The solution

Johannesburg is developing stormwater management policies (a stormwater bylaw and draft design manual) to lay the foundations for water resilience through stormwater management. Stormwater is an untapped resource that can help offset drinking-water shortages or supplement and reduce the pressure on the stormwater system downstream. Johannesburg's water system is fragmentary – managed by different entities on different levels in different systemic areas.

The city has developed a Water Security Strategy that sets out the challenges Johannesburg faces and the actions required to become a water-secure city by 2040. The strategy sets out a long-term vision with a view to enabling systemic change. To address the challenges of integrated water governance, the technical assistance programme worked to identify how Johannesburg could ensure that its institutions and governance structures supported, guided and influenced the water sector, were coordinated and shared one vision. It focused on five key focal areas, namely: (1) the existing structure, (2) mindset and culture, (3) leadership and governance, (4) skills and capability and (5) performance and talent management.

The road to implementation

The technical assistance work does not aim to orchestrate a complete organisational overhaul of the water sector in Johannesburg. Rather, it is trying to develop a new approach to working within the water sector, taking 'baby steps' towards new methods of collaboration between different city stakeholders. The objective is to explore new ways of doing this, which will, over time, lead to more fundamental organisational changes.

Impacts and benefits

Ensuring a shared vision and goals will create ownership and responsibility when it comes to action, ensuring that water-sector stakeholders are empowered with knowledge through deliberate capacity development. The impacts of tackling and mitigating the challenges of the Johannesburg water cycle will result in better management of supply and demand. This will ensure that the water system is resilient and sustainable, delivering equality and equitable access for all. Clarifying the mandates of the relevant institutions to strengthen capacity and knowledge, and developing a strategy on integrated water and data management will have both social and economic benefits for the city.

Which cities can inspire Johannesburg?

Copenhagen's stormwater management: Faced with stormwater volume increases of up to 40% and the risk of even stronger and more frequent downpours, Copenhagen decided to prepare a comprehensive cloudburst plan. The expected monetary gain from Copenhagen's project prompted Johannesburg to see that a climate-adapted city also made economic sense. Copenhagen City Council adopted its Cloudburst Management Plan in 2012, which acknowledged the future risks of increased stormwater volumes and more frequent cloudbursts. The full-scale rollout of multiple cloudburst projects across the Danish capital and draft plans for seven cloudburst catchment areas across the city showed Johannesburg that design is critical to increasing the city's blue and green infrastructure and preventing flooding. [14]

The city of Copenhagen is implementing the large-scale project over a 20-25-year period. Its water sector is divided between three key stakeholders: the city (regulatory and planning issues), the Greater Copenhagen Utility (a semi-private organisation)

and the Wastewater Treatment plants (owned by participating municipalities). To facilitate the work of the cloudburst plan, the city and utility set up a number of coordinating bodies to ensure the effective involvement (and ownership) of different municipal departments and to make sure that both organisations are on board with decisions on overall planning and implementation.

Melbourne's stormwater reuse: Fishermans Bend in Melbourne, Australia[15], is being transformed into a mixed-use area that will require a change in water services. Similar to Johannesburg, climate-change projections for Melbourne have identified that it is at risk of running out of water. Consequently, the city is focussing on more sustainable solutions for water provision. Melbourne shared with Johannesburg how its focus on boosting the resilience of its water supply was to diversify its sources as much as possible through a multi-scale approach to decreasing its reliance on potable water. Although Melbourne identified stormwater reuse as a holistic option, it also suggested that Johannesburg not be overly reliant on rainwater. Adopting an integrated approach would reduce servicing costs while ensuring a high quality of service.

Auckland's water strategy development: Both Johannesburg and Auckland are at different stages in of implementing their urban water strategies [16] for equitable and resilient water security. Their shared learning engagement allowed them to discuss opportunities for adopting similar approaches to addressing the water challenges they face. The cities brainstormed solutions for financing, capacity building, private-sector involvement, community education and mainstreaming to shift the narrative of water security in their respective contexts. One conclusion from the session was that the cities would like to continue engaging key stakeholders in conversation and to create new partnerships for co-delivery.

Cape Town's integrated water governance: The City of Cape Town has been severely impacted by drought conditions. Cape Town Water is seeking to adopt an integrated governance structure that is fit for purpose and in line with its strategy, [17] which sets out five commitments to ensuring sufficient water for all and developing a city that is more resilient to climate (and other) shocks. Integrated governance to support the strategy will be achieved by paying particular attention to the skills required to implement the new water strategy. Cape Town has recognised the need to integrate water supply and stormwater management and has transferred the responsibility of stormwater management from the roads department to Cape Town Water. The new approach to governance will reinforce the general support of water sensitivity principles by establishing a framework that directly addresses the transition to a water-sensitive city.

Conclusion and lessons learnt

The city of Johannesburg incorporates water sensitivity principles into its strategic development planning. This is central to implementing water-sensitive urban design, particularly given the significance of integrated development plans in determining the development trajectory of municipalities. The city is looking to do more to implement water-sensitive urban design as a permanent strategy. The strongest support for water sensitivity can be found in the city's climate change plans [18] and policies. Given the effects of climate change, these plans reinforce the need to adopt adaptive actions to minimise urban flooding and stormwater recycling initiatives to enhance water supply management and promote water security in the city. **To guide Johannesburg towards achieving its goal of being water secure, the city will need to ensure an integrated governance structure that supports the implementation of water strategy objectives.**

What can other cities learn from Johannesburg?

With a greater focus on water as a critical resource for cities, it has become increasingly important for cities to look at their water governance structures. The case of Johannesburg clearly shows that although it might not be possible to undertake a full organisational change, starting the discussion is critical to improving water governance. This needs to be done at all levels and requires a lot of cross-sectoral coordination and discussion to slowly start the move towards water governance as an integrated system.

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Photo @Tebogo Losaba @Unsplash

Endnotes

[1] C40: "The future we don't want". Available at: https://www.c40.org/what-we-do/scaling-up-climate-action/adaptation-water/the-future-we-dont-want/#:~:text=The%20Future%20We%20Don't%20Want%20is%20a%20collaboration%20between,as%20a%20result%20of%20climate.

[2] C40: "The future we don't want". Available at: https://www.c40.org/what-we-do/scaling-up-climate-action/adaptation-water/the-future-we-dont-want/#:~:text=The%20Future%20We%20Don't%20Want%20is%20a%20collaboration%20between,as%20a%20result%20of%20climate.

[3] IPCC - ARC3 Synthesis report. Available at: https://www.ipcc.ch/report/sixth-assessment-report-cycle/

[4] Urban heat islands occur when cities replace natural land cover with dense concentrations of pavement, buildings, and other surfaces that absorb and retain heat. This effect increases energy costs (e.g., for air conditioning), air pollution levels, and heat-related illness and mortality. See US EPA (n.d.) "Reduce Urban Heat Island Effect", Washington, DC. Available at: https://www.epa.gov/green-infrastructure/reduce-urban-heat-island-effect#:~:text=%22Urban%20heat%20islands%22%20occur%20when,heat%2Drelated%20illness%20and%20mortality.

[5] "Actions to protect, conserve, restore, sustainably use and manage natural or modified terrestrial, freshwater, coastal and marine ecosystems, which address social, economic and environmental challenges effectively and adaptively, while simultaneously providing human well-being, ecosystem services and resilience and biodiversity benefits." See Nature-based Solutions Initiative (2022), "United Nations Environment Assembly agree Nature-based Solutions definition", Oxford, UK. Available at: https://www.naturebasedsolutionsinitiative.org/news/united-nations-environment-assembly-nature-based-solutions-definition/.

[6] [insert source of the quote here]

[7] McKernan, B. (2021) "Turkey drought: Istanbul could run out of water in 45 days", The Guardian, 13 January 2021. Available at: https://www.theguardian.com/world/2021/jan/13/turkey-drought-istanbul-run-out-water-45-days.

[8] Ilhan, A. (2021) "Istanbul's Water Crisis", Green European Journal, 8 November 2021. Available at: https://www.greeneuropeanjournal.eu/istanbuls-water-crisis/.

[9] NRW is water that has been pumped from source, but then lost somewhere in the system.

[10] Zero-pressure testing is part of the installation process for pressure management technology. Tests are done to see if there are any unmapped inflows that need to be taken into account before smart pressure-reducing valves are installed.

[11] A SCADA system is a combination of hardware and software enabling the capture of data within, and automation of, industrial processes. SCADA connects the sensors that monitor equipment like motors, pumps, and valves to an onsite or remote server.

[12] i20 (n.d.) "Our clients: Ethekwini Municipality", Southampton, UK. Available at: https://en.i2owater.com/clients/ethekwini-municipality/.

[13] Schneider, U., Becker, A., Finger, P., Meyer-Christoffer, A., Ziese, M. and Rudolf, B. (2014) "GPCC's new land surface precipitation climatology based on quality-controlled in situ data and its role in quantifying the global water cycle". Theoretical and Applied Climatology, 115(1): 15–40. Available at: https://link.springer.com/article/10.1007/s00704-013-0860-x.

[14] C40 Cities (2015) "Cities100: Copenhagen - Green Infrastructure Prevents Flooding", London. Available at: https://www.c40.org/case-studies/cities100-copenhagen-green-infrastructure-prevents-flooding/.

[15] CRC for Water Sensitive Cities (2020) "Collaboration results in water management innovations for Fishermans Bend", 19 May 2020. Available at: https://watersensitivecities.org.au/content/collaboration-results-in-water-management-innovations-for-fishermans-bend/.

[16] Auckland Council (2022) Auckland Water Strategy, Auckland. Available at: https://www.aucklandcouncil.govt.nz/environment/looking-after-aucklands-water/Documents/auckland-water-strategy.pdf.

[17] City of Cape Town (n.d.) Our Shared Water Future: Cape Town's Water Strategy. Cape Town, South Africa. Available at: https://resource.capetown.gov.za/documentcentre/Documents/City%20strategies,%20plans%20and%20frameworks/Cape%20Town%20Water%20Strategy.pdf.

[18] City of Johannesburg (2021) City of Johannesburg Climate Action Plan. Johannesburg, South Africa. Available at: https://www.joburg.org.za/departments_/Documents/EISD/City%20of%20Johannesburg%20-%20Climate%20Action%20Plan%20%28CAP%29.pdf.